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भारत सरकार
जल संसाधन मंत्रालय
केन्द्रीय भूमिजल बोर्ड
GOVERNMENT OF INDIA
MINISTRY OF WATER RESOURCES
CENTRAL GROUND WATER BOARD

महाराष्ट्र राज्य के अंतर्गत बीड जिले की भूजल विज्ञान जानकारी

GROUND WATER INFORMATION BEED DISTRICT MAHARASHTRA

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मध्य क्षेत्र, नागपुर
CENTRAL REGION
NAGPUR
2014

BEED DISTRICT AT A GLANCE

1. GENERAL INFORMATION

Geographical Area	:	10440.35 sq. km.
Administrative Divisions (As on 31/03/2011)	:	Taluka- 11, Beed, Georai ,Ashti , Patoda, Shirur (Kasar), Wadwani , Ambajogai, Majalgaon, Kaij, Dharur and Parli.
Villages	:	1360
Population (2011 Census)	:	21,61,000
Average Annual Rainfall	:	674.77 mm

2. GEOMORPHOLOGY

Major Physiographic unit	:	3; Lowland Beed- Part of Godavari valley, Highland Beed- Part of Balaghat Plateau and Sina basin
Major Drainage	:	3; Godavari, Manjra and Sindphana

3. LAND USE (2011)

Forest Area	:	180 sq. km.
Cultivable Area	:	8030 sq. km.
Net Area Sown	:	7420 sq. km.

4. SOIL TYPE

Rocky and thin layered soils except on the banks of Godavari and Sina Rivers.

5. PRINCIPAL CROPS (2010-11)

Food Grains	:	5300 sq. km.
Oilseeds	:	900 sq. km.
Total Pulses	:	1100 sq. km.
Sugarcane	:	360 sq. km.
Cotton	:	1080 sq. km.

6. IRRIGATION BY DIFFERENT SOURCES (4th MI Census, 2006-07)- Nos./Potential Created/Potential Utilized (ha)

Dugwells	:	42151 / 135056 / 128799
Tubewells/Borewells	:	7476 / 18051 / 17525
Surface Flow Schemes	:	1674 / 9787 / 5421
Surface Lift Sources	:	1190 / 2982 / 2822
Net Irrigated Area	:	154567

7. GROUND WATER MONITORING WELLS (As on 2011)

Dugwells	:	37
Piezometers	:	6

8. GEOLOGY

Recent	:	Alluvium
Upper Cretaceous-Lower Eocene	:	Deccan Trap Basalt

9. HYDROGEOLOGY

Water Bearing formation	:	Basalt-Weathered/fractured/ jointed vesicular/massive, under phreatic and semi-confined to confined conditions. Alluvium- Sand and Gravel under semi-confined to confined conditions.
Premonsoon Depth to Water Level (May-2011)	:	0.80 to 11.95 m bgl
Postmonsoon Depth to Water Level (Nov.-2011)	:	1.00 to 9.10 m bgl
Premonsoon Water Level Trend (2002-2011)	:	Rise: 0.06 to 1.30 m/year Fall: 0.04 to 0.08 m/year
Postmonsoon Water Level Trend (2002-2011)	:	Rise: 0.04 to 1.26 m/year Fall: Negligible to 1.51 m/year

10. GROUND WATER EXPLORATION (As on 31/03/2011)

Wells Drilled	:	EW-52, OW-11, Pz-05
Depth Range	:	18.00 to 200.20 m bgl
Discharge	:	Traces to 19.66 lps

11. GROUND WATER QUALITY

Good and suitable for drinking and irrigation purpose, however localized nitrate contamination is observed.

12. DYNAMIC GROUND WATER RESOURCES- (As on 31/03/2009)

Net Annual Ground Water Availability	:	1344.37 MCM
Annual Ground Water Draft (Irrigation + Domestic)	:	685.38 MCM
Allocation for Domestic and Industrial requirement up to next 25 years	:	94.78 MCM
Stage of Ground Water Development	:	50.98 %

14. GROUND WATER CONTROL & REGULATION

Over-Exploited Taluka	:	None
Critical Taluka	:	None
Notified Taluka	:	None

16. MAJOR GROUND WATER PROBLEMS AND ISSUES

Ground water quality is adversely affected by nitrate contamination in 50% ground water samples collected in May 2011. Thus all the wells used for water supply should be first analysed for nitrate and if the content is found beyond permissible limits then the ground water may be used for other than drinking purpose. Adequate sanitary protection to the wells may be provided to control the nitrate contamination

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1.0 Introduction

Beed is one of the district of Marathwada area of Maharashtra. It is situated flanked by Aurangabad and Jalna districts in the north, Parbhani in the east, Latur in the south east, Osmanabad in in south and Ahmadnagar district in the west and southwest. It is bounded by north latitude 18°28' and 19°28' and east longitude between 74°48' and 76°45'. The district headquarters is located at Beed Town. For administrative purpose the district has been divided in 11 talukas viz., Beed, Georai, Patoda, Ashti, Shirur (Kasar), Ambajogai, Kaij, Majalgaon, Dharur, Parli (Vaijnath) and Wadwani.

As per census 2011, the population of the district is 25.85 lakh. The district has 6 towns and 1360 villages. The major part of the district comes under Godavari basin. Godavari, Manjra and Sina are the major rivers that drain the district along with their tributaries.

Central Ground Water Board has taken up several studies in the district. A list of studies conducted in the district is presented in **Table-1**.

Table 1: Studies Undertaken by CGWB.

S.N.	Officer	AAP	Type of Survey/Study
1	N.G. Gajbhiye	1972-73	Systematic Hydrogeological Survey
2	D.Y. Sirsikar	1980-81	-do-
3	D.B. Shetye	1985-86	-do-
4	D.B. Shetye	1986-87	-do
5	D.B. Shetye	1988-89	-do
6	AVSS. Anand & S. Marwaha	1989-90	-do-
7	S. Kudesia	1992-93	Reappraisal Hydrogeological Study
8	B. K. Kallapur	1994-95	-do-
9	K.B. Sahoo	1995-96	-do-
10	P.K. Naik	1996-97	-do-
11	B.N. Warke	1997-98	-do-

A report on hydrogeology of the district entitled "Ground Water Resources and Development Potential of Beed District, M.S." was compiled by Shri K.N. Murthy, Scientist-D in the year 1999-2000.

Apart from above studies, ground water exploration in the hard rock areas of the district occupied by Deccan Trap Basalt has also been taken up in various phases since 1995. The salient features of ground water exploration are given in Table-2.

Table 2: Salient Features of Ground Water Exploration. (March 2011)

S. No.	Taluka	Wells			Depth (m bgl)	SWL (m bgl)	Discharge (lps)	Draw-Down (m)	Zones (m bgl)
		EW	OW	PZ					
1.	Ambejogai	1	-	2	31.75 - 200.00	4.35 - 10.20	Traces – 0.14	-	20-42
2.	Ashti	9	2	-	122.10 - 200.00	3.40 – 46.82	0.38 – 5.80	-	5 – 159
3.	Beed	7	3	-	65.65 – 200.00	6.80 - >100.00	Traces – 5.90	2.16 – 23.50	18 - 125
4.	Dharur	1	1	-	150.00 – 200.00	13.46 – 20.50	1.05 – 4.43	-	15.70 – 146.90
5.	Gevrai	10	1	2	18.00 – 200.00	3.11 - >60.00	Traces – 17.92	11.87 – 21.82	9 - 125
6.	Kaij	5	3	-	110.00 – 200.00	6.90 – 63.53	0.16 – 19.66	-	27.00 – 131.00
7.	Majalgaon	5	-	-	18.00 – 200.20	14.10 – 50.00	3.17 – 4.43	-	16 – 195
8.	Parli	3	-	-	200.20	37.40 – 90.10	-	-	18 - 127
9.	Patoda	3	1	-	95.00 – 200.00	5.60 – >100	0.14 - 3.17	-	15 - 80
10.	Shirur	5	-	1	38.00 - 200.00	4.10 - >100	Traces – 2.43	13.40	6 – 165
11.	Wadvani	3	-	-	200.20	41.10	-	-	8 - 182
	Total	**52**	**11**	**5**	**18.00 – 200.20**	**3.11 - >100**	**Traces – 19.66**	**2.16 – 21.82**	**5 - 195**

In the Deccan Trap Basalt area of the district, 52 exploratory wells (EW), 11 observation wells (OW) and 5 Piezometer (PZ) were drilled**.** The depth of the wells ranged from 18.00 to 200.20 metres below ground level (m bgl). The discharge from these wells varied from Traces to 19.66 litres per second (lps), and 20 wells (29%) were found to be high yielding with discharge > 3 lps. The static water levels ranged from 3.11 to > 100 m bgl. The aquifer zones were encountered in the depth range of 5 m bgl to 195 m bgl, thus indicating the presence of water bearing zones even at deeper depths beyond 100 m bgl. In addition to this 8 piezometers have been drilled through outsourcing in 1997-98 under HP-I, whereas 10 wells have been drilled under accelerated ground water exploration programme through outsourcing in 2004-05.

A map of the district showing the taluka boundaries, taluka headquarters, and location of monitoring wells is presented as **Figure-1**. The locations of exploratory wells are shown in **Figure-2**.

2.0 Climate and Rainfall

The Climate of the district is characterized by a hot summer and general dryness throughout the year except during the south-west monsoon season, i.e., June to September. The temperature rises rapidly after February till May, which is the hottest month of the year. The mean daily maximum temperature during May is 42.0°C and the mean daily minimum temperature during December is 12.0°C

The normal annual rainfall (1901-1996) varies from about 600 to 800 mm. It

is minimum in the western part around Ashti and gradually increases towards east and reaches maximum around Majalgaon. The study also reveals that except the western part of the district around Ashti, the entire district experienced moderate and severe drought conditions for more than 20% of the years and can be categorized as “drought area”.

The average annual rainfall of period 2003-2011 in the district varied from 574 mm (Shirur) to 794 mm (Dharur) and the same is presented in Table-3.

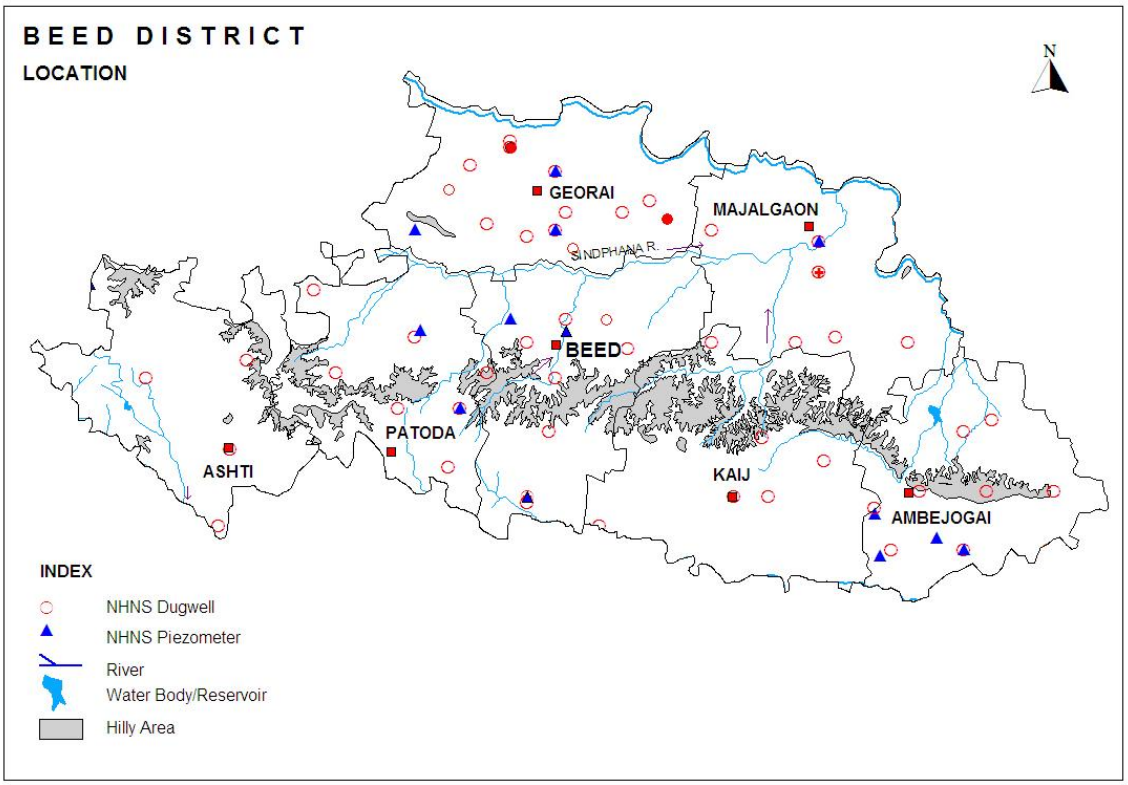

Figure-1: Location

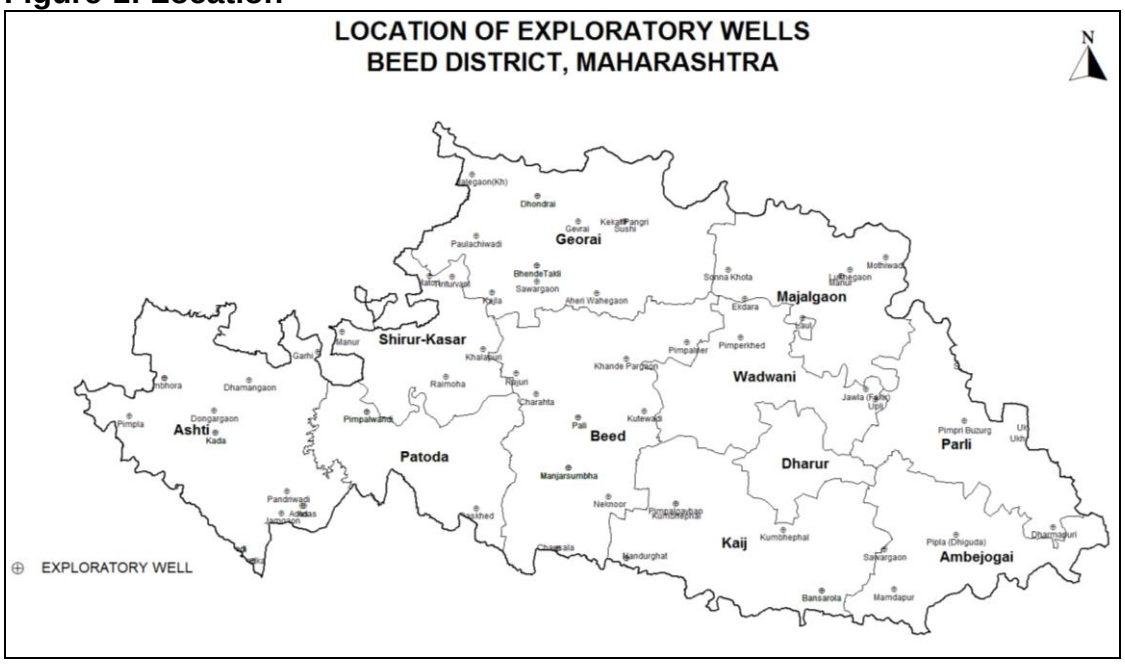

Figure-2: Location of Exploratory Wells

Table 3: Annual Rainfall Data (2002-2011). (mm)

S.	Taluka	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Avg.
1	Ambejogai	649	758	710	914	825	706	657	777	1000	834	**783**
2	Ashti	784	621	1027	406	860	748	624	673	924	385	**705**
3	Beed	556	502	695	879	678	674	696	677	815	825	**700**
4	Dharur	640	870	747	1049	579	690	634	786	1156	788	**794**
5	Gevari	750	660	638	900	777	607	590	786	859	589	**716**
6	Kej	469	624	611	1118	819	511	625	659	1019	675	**713**
7	Majalgaon	649	740	597	906	720	966	588	568	1135	630	**750**
8	Parali	729	743	468	604	564	926	750	533	1047	468	**737**
9	Patoda	560	356	740	741	868	702	554	663	810	448	**644**
10	Shirur	431	540	687	675	697	573	522	588	619	407	**574**
11	Wadvani	550	692	469	1048	634	747	648	654	1034	707	**718**

3.0 Geomorphology and Soil Types

The district can be broadly divided into 3 physiographic units namely; Lowland Beed, Highland Beed and Sina basin.

Lowland Beed is the low lying northern part comprising a part of Godavari valley and is also known as Gangathari. It has a general elevation rangiong from 400 metre above mean sea level (m amsl) in the east to 500 m amsl in the west with number of residual hills reaching upto 600 m amsl. Highland Beed occupies the southern part forming a part of Balaghat Plateau. This dissected series of hills extending from west to east divides the district into two parts. Sina basin is low lying undulating area southwest and west of Highland Beed comprising almost whole of Ashti taluka. It is interspersed with many low lying residual hills. The district is drained by Godavari, Manjra and Sina rivers and their tributaries. Godavari River flows from west to east along the northern boundary of the district. Manjra River starts from the mountains of Patoda taluka and flows west to east forming the southern boundary of the district. Sina River flows along the south-western boundary of the district.

In the district, rocky and thin layered soils are observed in major part of the district except on the banks of Godavari and Sindphana Rivers, where dark brown to black and clayey loamy to loamy soils are observed. The nutrient levels in almost all the soils are low.

4.0 Ground Water Scenario

4.1 Hydrogeology

The major part of the district is covered by Basaltic flows commonly known as Deccan Traps of Upper Cretaceous-Lower Eocene age. Alluvial deposits of Recent to Sub-Recent age are observed along the river courses of Godavari and Sindphana. A map depicting the hydrogeological features is shown in **Figure-3**.

4.1.1 Hard Rock Areas

4.1.1.1 Deccan Trap Basalt

The Deccan Trap includes several flows of Basalt which are supposed to have extruded from fissure volcanoes. Ground water in Deccan Trap Basalt occurs mostly in the upper weathered and fractured parts down to 20-25 m depth. At places potential zones are encountered at deeper levels in the form of fractures and inter-flow zones. The upper weathered and fractured parts form phreatic aquifer and ground water occurs under water table (unconfined) conditions. This aquifer is tapped by mainly dugwells in the depth range of 3.00 to 29.60 m bgl and their yield ranges between 5700 and 72900 lph. At deeper levels, the ground water occurs under semi-confined conditions. These are tapped by Dug-cum-Borewell (DCB) ranging in depth from 11 to 50 m bgl.

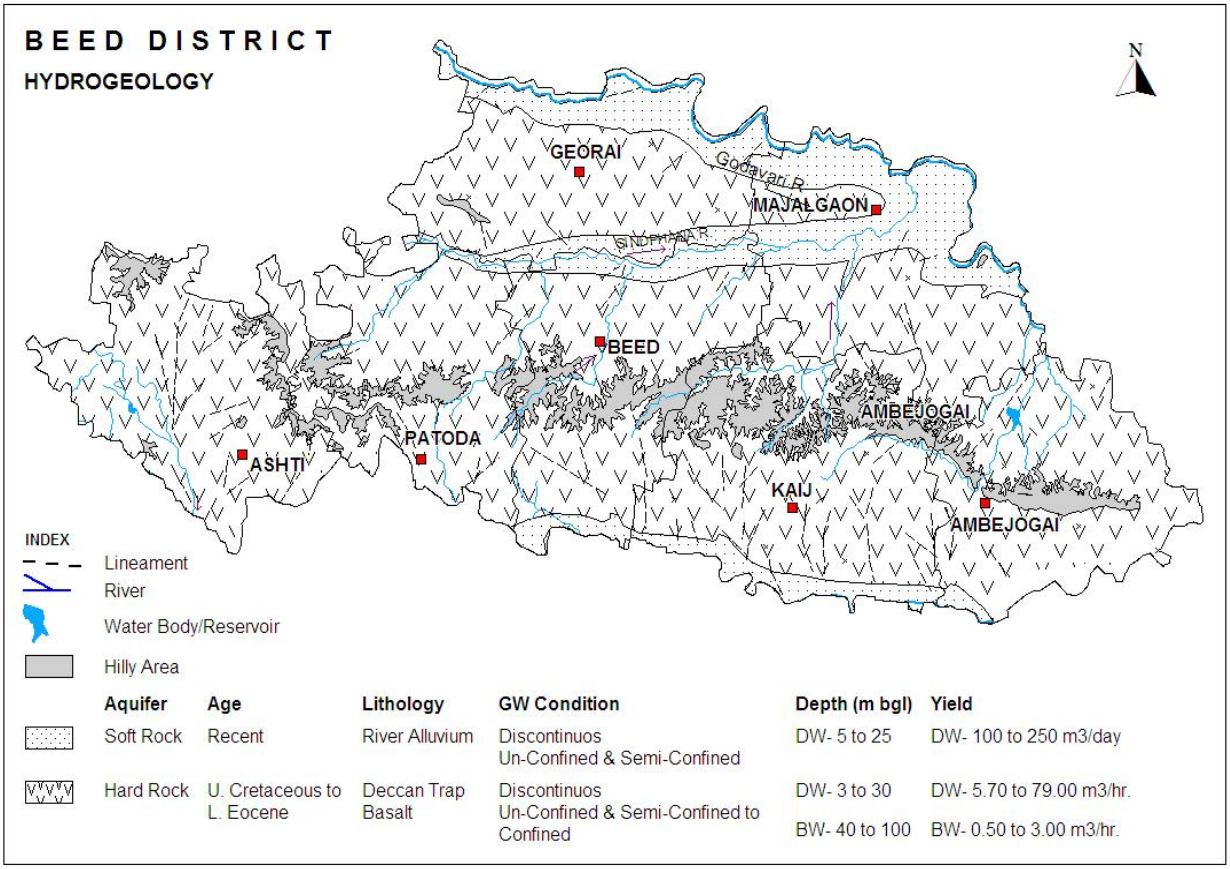

Figure-3: Hydrogeology

The confined aquifers in Basalt are encountered at depth of more than 40 to 50 m and are tapped by borewells ranging in depth from 40 to 100 m bgl. Borewells drilled down to 70 m depth, tapping weathered and vesicular basalt are found to yield 500 to 3000 lph. As per Ground Water Exploration data deeper potential aquifers below 100 m bgl have been observed in Gevrai and Ashti talukas.

4.1.2 Soft Rock Areas

4.1.2.1 Alluvium

Alluvial deposits occur in long narrow basin along Godavari and Sindphana rivers. About a 10% area of the district is occupied by Alluvium. It

consists of sand, gravels and boulders with intercalations of clays and silt. The beds of sand and gravels are discontinuous and lenticular and pinch out laterally within short distance. Ground water occurs under phreatic and semi-confined conditions in inter granular pore spaces of gravel and sand. This aquifer is tapped mainly by dugwells ranging in depth 5 to 25 m bgl with 2 to 3 m diameter and the yield varies from 100 to 250 m^3/day.

4.2 Water Level Scenario

Central Ground Water Board periodically monitors 43 Ground Water Monitoring Wells (GWMW) stations in Beed district, four times a year i.e. in January, May (Premonsoon), August and November (Postmonsoon).

4.2.1 Depth to Water Level – Premonsoon (May-2011)

The depth to water levels in the district during May 2011 ranges between 0.8 (Wadwani) and 11.95m bgl (Tintawarni). Depth to water levels during premonsoon (May 2011) has been depicted in **Figure-4**.

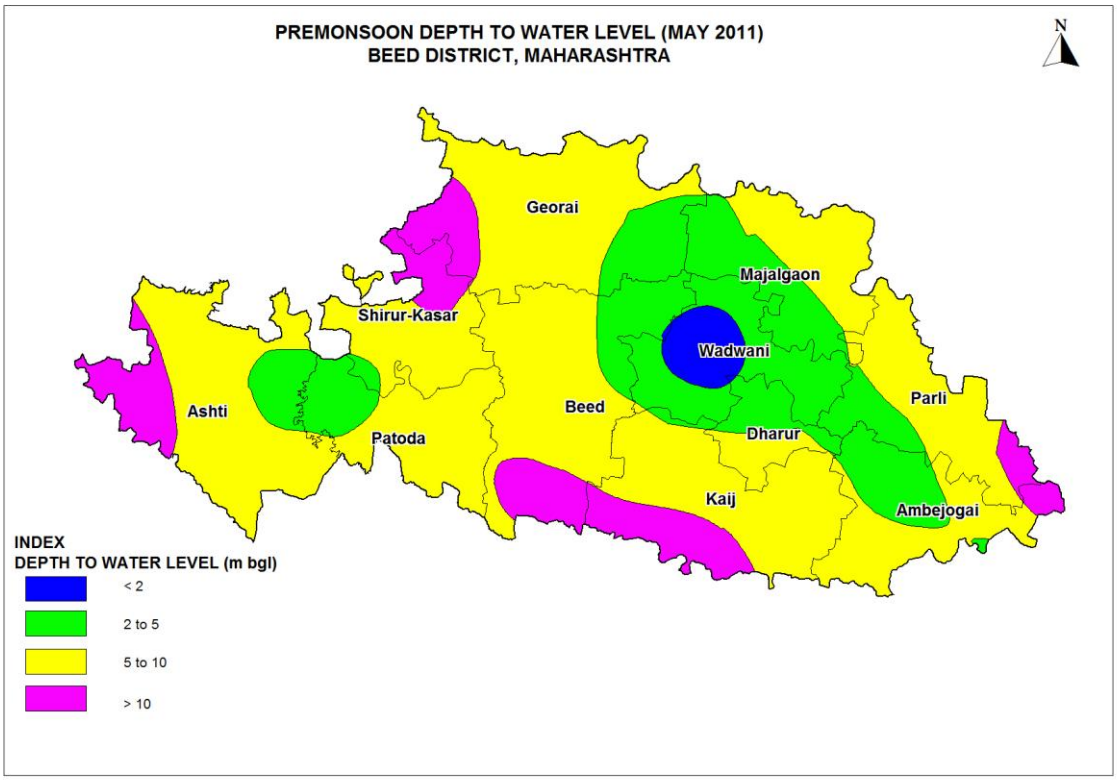

Figure-4: Depth to Water Level (Premonsoon- May 2011)

Shallow water levels within 2 mbgl are observed in an isolated patch in central part of the district in Wadvani taluka. The water levels between 5 and 10 m bgl are observed in major parts of the district in north-central, south-central, western and eastern parts. The moderate to deeper water levels of 10 to 20 m bgl are observed in western, North western, south and eastern parts of the district, occupying parts of Ashti, Beed, Kaij, Georai talukas. The water levels between 2 and 5 m bgl are observed in elongated patch in northwest-south east direction occupying parts of parts of Georai, Majalgaon, Wadwani, Dharur and Ambejogai talukas.

4.2.2 Depth to Water Level – Postmonsoon (Nov.-2011)

The depth to water levels in the district during Nov. 2011 ranges between 1.00 (Ambajogai) and 9.10 m bgl (Chousala). Depth to water levels during post-monsoon (Nov. 2011) has been depicted in **Figure-5**.

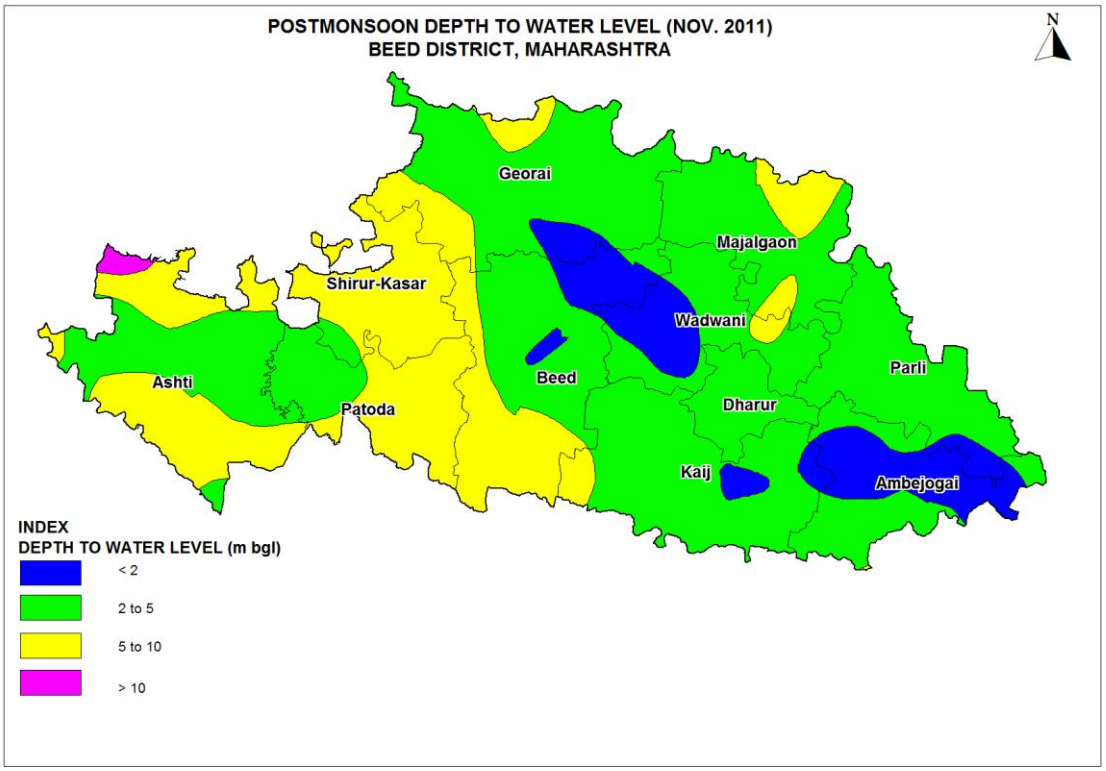

Figure-5: Depth to Water Level (Postmonsoon- Nov. 2011)

In major parts of the district water levels are between 2 and 5 m bgl, predominantly observed in entire eastern part of the district, occupying major parts of Georai, Wadwani, Dharur, Beed, Kaij, Majalgaon and Parli. The water levels, between 5 and 10 m bgl are seen central-western patch i.e., almost entire Shirur, Patoda and southern parts of Beed and Ashti talukas. Shallow water levels less than 2 m bgl are observed in parts of Georai, Beed, Wadwani and Ambajogai talukas.

4.2.3 Seasonal Water Level Fluctuation– (May-Nov. 2011)

The seasonal rise in water levels in the district ranges from 0.011 (Kanherwadi) to 1.55 m (Tintarwani). In major parts of the district water level fluctuation in the range of 0 to 2 m is observed in northern and western parts of the district occupying parts of Georai, Wadwani, Majalgaon, Shirur-Kasar, Patoda and Ashti. Water level fluctuation in the range of 2 to 4 m is observed in central and southern parts of the district and fluctuation of more than 4 m is observed in parts of Ambejogai and Kaij talukas.

4.2.4 Water Level Trend (2002-2011)

Trend of water levels for premonsoon and postmonsoon period for last ten years (2002-2011) have been computed for 43 NHNS. The analysis of trend

indicates that during premonsoon period, rise in water level has been recorded at 26 stations and it ranges between 0.06 (Dharampuri) and 1.30 m/year (Badrapur2). The fall in water level trend has been observed at only 2 stations and it ranges between 0.04 (Mauj) and 0.08 m/year (Khadkat). During postmonsoon period, rise in water levels has been recorded at 16 stations and it ranges from 0.04 (Adas) to 1.26 m/year (Tintarvani), whereas at 15 stations, fall in water level ranging between Negligible (Pali) and 1.51 m/year (Pendgaon) is observed. Thus especially during postmonsoon period declining trends of water levels have been observed.

The premonsoon water level trend map was also prepared for the period May 2002-2011 and the same is presented in **Figure- 6**. A perusal of the map indicates that in major part of the district the rising trend of water level in the range 0 to 0.20 m/year is observed. The falling trend of water level in the range of 0 to 0.20 m/year is observed in northern eastern parts of the district (in parts of Georai and Beed talukas) and in south-eastern (parts of Ambejogai and Parli talukas) and western part of the district (in Ashti taluka).

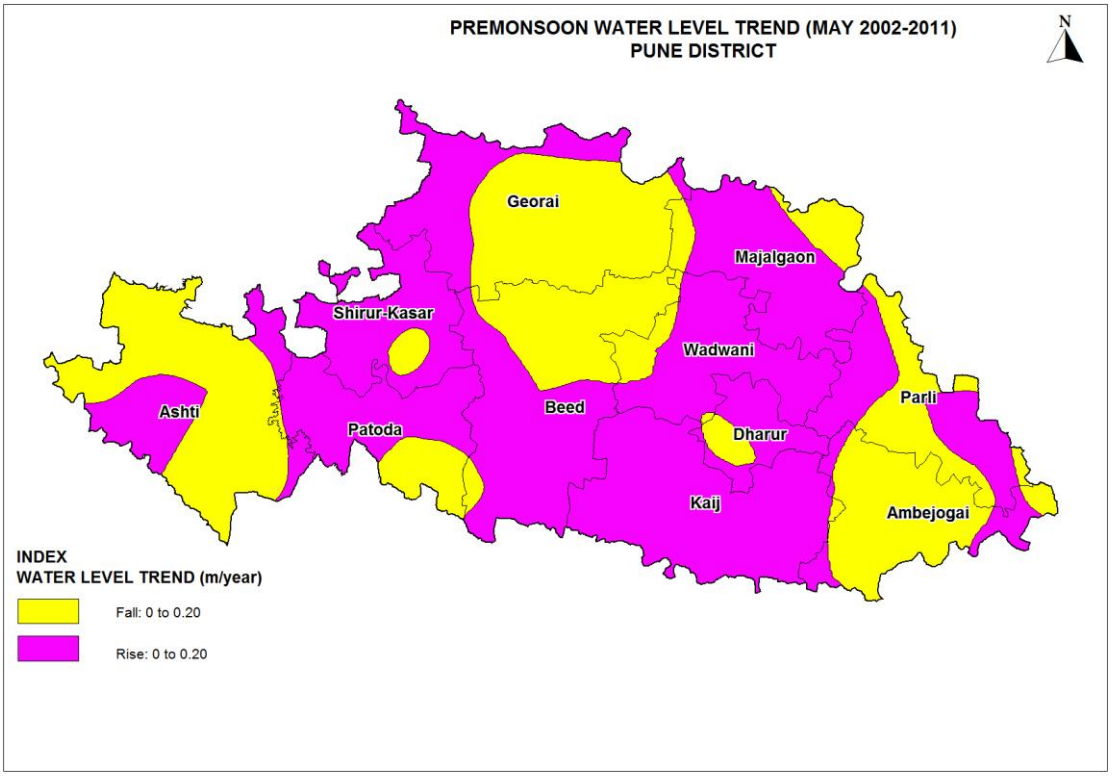

Figure-6: Premonsoon Water Level Trend (May 2002-2011)

4.3 Aquifer Parameters

The aquifer parameters of shallow aquifer as determined during previous studies carried out by the Board indicate that in Basalt the specific capacity ranges from 35 to 1992 lpm/m of drawdown. The pumping tests conducted on exploratory wells indicates that transmissivity varies between 20 and 456 m^2/day and storativity ranges from $7.6x10^{-3}$ to $7.4 x10^{-3}$.

4.4 Yield of Dugwells and Borewells

The yields of the wells are function of the permeability and transmissivity of

aquifer encountered and it varies with location, diameter and depth of wells etc. There are mainly two types of ground water abstraction structures in the district i.e., dugwells and borewells, however the yield of wells also vary according to nature of formation tapped and its saturated thickness. Therefore, the dugwells located in the topographic lows, morphological depressions and on or near the lineaments yield comparatively more water than the located elsewhere, which is particularly true in basaltic terrain. The depth of the dugwells varies between 3 and 30 m bgl in Deccan Trap Basalt and its yield varies from 5700 to 72900 lph for drawdown of about 0.30 to 5.50 m. In Alluvial area, the depth of the dugwells ranges from 5 to 25 m bgl and the yield varies from 100 to 250 m^3/day.

In the exploratory wells of CGWB the discharge ranges from traces to 19.66 lps, and 20 wells (29%) were found to be high yielding with discharge > 3 lps. The borewells drilled by State ground water department/agency in Deccan Trap Basalt indicate wide variation in the range of 500 to 3000 lph, however in most of the borewells it varies from 500 to 700 lph.

4.5 Ground Water Resources

Central Ground Water Board and Ground Water Survey and Development Agency (GSDA) have jointly estimated the ground water resources of Dhule district based on GEC-97 methodology. The same is presented in **Table-4**. Ground Water Resources assessment was done for 10352 sq. km. area of which 1042.27 sq. km. is under command and 9309.78 sq. km. is non-command.

As per the estimation, the total annual ground water recharge is 1416.62 MCM with the natural discharge of 72.24 MCM, thus the net annual ground water availability comes to be 1344.38 MCM. The gross draft for all uses is estimated at 685.38 MCM with irrigation sector being the major consumer having a draft of 637.78 MCM. The allocation for domestic and industrial requirements for the next 25 years is worked out at 94.78 MCM, whereas the net ground water availability for future irrigation is estimated at 611.81 MCM. The stage of ground water development varies from 37.78% (Parali) to 59.4 % (Beed) and all the talukas falls in “Safe” category. The overall stage of ground water development for the district is 50.98 %. Similarly, the ground water resources were also assessed for all the 48 watersheds and 47 watersheds have been categorised as “Safe” whereas, 1 watershed i.e., MR-15, which has achieved 96.40% stage of ground water development has been categorised as “Semi-Critical”.

Table 4: Ground Water Resources (March 2009).

Taluka	Area type	Net annual ground water Availability (ham/yr.)	Annual Ground water Draft (ham/yr.)			Allocation for domestic & Industrial Requirement Supply up to next 25 years (ham/yr.)	Ground water Availability for Future irrigation (ham/yr.)	Stage of Ground water Development (%)	Category
			Irrigation	Domestic & Industrial uses	Total				
BEED	Command	2302.4	540.03	52.42	592.45				
	Non-command	13411.6	8002.96	738.27	8741.23				
	total	15713.64	8542.99	790.69	9333.67	1558.39	4914.22	59.4	Safe
GEVRAI	Command	7569.46	2249.82	120.29	2370.11				
	Non-command	13832.48	9388.26	483.52	9871.79				
	total	21401.94	11638.09	603.81	12241.9	1207.02	8443.02	57.2	Safe
PATODA	Command	741.32	148.15	37.87	186.02				
	Non-command	7719.9	4452.57	274.46	4727.03				
	total	8461.22	4600.72	312.33	4913.05	621.95	3228.17	58.07	Safe
ASHTI	Command	3178.03	1012.65	178.16	1190.81				
	Non-command	14293.39	7256.68	627.89	7884.58				
	total	17471.42	8269.33	806.06	9075.39	1616.12	7625.95	51.94	Safe
AMBAJOGAI	Command	789.58	187.22	20.44	207.66				
	Non-command	9952.22	4429.29	347.36	4776.65				
	total	10741.8	4616.51	367.8	4984.31	698.94	6054.71	46.4	Safe
MAJALGAON	Command	7954.75	2256.87	121.3	2378.17				
	Non-command	6047.48	3386.24	223.57	3609.8				
	total	14002.23	5643.11	344.86	5987.97	663.45	7763.48	42.76	Safe
KAIJ	Command								
	Non-command	16051.88	7855.41	648.78	8504.19				
	total	16051.88	7855.41	648.78	8504.19	1319.14	7580.12	52.98	Safe
DHARUR	Command	466.47	67.27	10.44	77.71				
	Non-command	2674.71	1573.92	58.42	1632.34				
	total	3141.19	1641.19	68.86	1710.05	121.15	1517.97	54.44	Safe
WADWANI	Command	2499.41	273.43	19.58	293.01				
	Non-command	7373.41	3468.32	282.76	3748.17				
	total	9872.83	3738.83	302.35	4041.18	618.71	4897.72	40.93	Safe
SHIRUR	Command	976.23	216.54	21.78	238.32				
	Non-command	6018.65	3251.78	258	3509.78				
	total	6994.88	3468.32	279.78	3748.1	558.63	2968.6	53.58	Safe
PARLI	Command	4615.7	820.09	61.35	881.44				
	Non-command	5968.94	2943.48	173.53	3117.01				
	total	10584.64	3763.57	234.88	3998.46	495.02	6187.1	37.78	Safe
DISTRICT	**Command**	**31093.35**	7772.07	643.63	8415.7			50.98	
	Non-command	**107960.36**	56829	4177.91	61004.01				
	total	**134437.70**	63778.07	4760.20	68538.27	9478.52	61181.06		Safe

4.6 Ground Water Quality

CGWB is monitoring the ground water quality of the Beed district since the last four decades through its established monitoring wells. The objectives behind the monitoring are to develop an overall picture of the ground water quality of the district. During the year 2011, the Board has carried out the ground water quality monitoring of 7 monitoring wells. These wells mainly consist of the dug wells representing the shallow aquifer. The sampling of ground water from these wells was carried out in the month of May 2011 (pre-monsoon period). The water samples after collection were immediately subjected to the analysis of various parameters in the Regional Chemical Laboratory of the Board at Nagpur. The parameters analyzed, include pH, Electrical Conductivity (EC), Total Alkalinity (TA), Total Hardness (TH), Nitrate (NO_3) and Fluoride (F). The sample collection, preservation, storage, transportation and analysis were carried out as per the standard methods given in the manual of American Public Health Association for the Examination of Water and Wastewater (APHA, 1998). The ground water quality data thus generated was first checked for completeness and then the validation of data was carried out using standard checks. Subsequently, the interpretation of data was carried out to develop the overall picture of ground water quality in the district in the year 2011.

4.6.1 Suitability of Ground Water for Drinking Purpose

The suitability of ground water for drinking purpose is determined keeping in view the effects of various chemical constituents in water on the biological system of human being. Though many ions are very essential for the growth of human, but when present in excess, have an adverse effect on human body. The standards proposed by the Bureau of Indian Standards (BIS) for drinking water (IS-10500-91, Revised 2003) were used to decide the suitability of ground water. The classification of ground water samples was carried out based on the desirable and maximum permissible limits for the parameters viz., TA, TH, NO_3 and F prescribed in the standards and is given in **Table-5**.

Table-5: Classification of Ground Water Samples for Drinking based on BIS Drinking Water Standards (IS-10500-91, Revised 2003)

Parameters	DL	MPL	Samples with conc. < DL	Samples with conc. in DL-MPL	Samples with conc. >MPL
TH (mg/L)	300	600	3	4	-
TA (mg/L)	200	600	7	-	-
NO_3 (mg/L)	45	No relaxation	3	-	4
F (mg/L)	1.0	1.5	7	-	-

(Here, DL- Desirable Limit, MPL- Maximum Permissible Limit)

The perusal of **Table-5** shows that the concentrations of all the parameters except nitrate in most of the samples are the maximum permissible limit of the within BIS standards. It is also seen from the **Table-5** that the potability of ground water in the wells is mainly affected due to the Nitrate (NO_3) as its concentration exceeds more than MPL in 50% of samples. Overall, it can be concluded that the ground water quality in the wells monitored in the district is

affected because of high NO_3 concentrations.

4.6.2 Suitability of Ground Water for Irrigation Purpose

The water used for irrigation is an important factor in productivity of crop, its yield and quality of irrigated crops. The quality of irrigation water depends primarily on the presence of dissolved salts and their concentrations. Electrical Conductivity (EC) and Residual Sodium Carbonate (RSC) are the most important quality criteria, which influence the water quality and its suitability for irrigation.

4.6.2.1 Electrical Conductivity (EC)

The amount of dissolved ions in the water is best represented by the parameter electrical conductivity. The classification of water for irrigation based on the EC values is as follows.

Low Salinity Water (EC: 100-250 µS/cm): This water can be used for irrigation with most crops on most soils with little likelihood that salinity will develop.

Medium Salinity Water (EC: 250 – 750 µS/cm): This water can be used if moderate amount of leaching occurs. Plants with moderate salt tolerance can be grown in most cases without special practices for salinity control.

High Salinity Water (EC: 750 – 2250 µS/cm): This water cannot be used on soils with restricted drainage. Even with adequate drainage, special management for salinity control may be required and plants with good salt tolerance should be selected.

Very High Salinity Water (EC: >2250 µS/cm): This water is not suitable for irrigation under ordinary condition. The soils must be permeable, drainage must be adequate, irrigation water must be applied in excess to provide considerable leaching and very salt tolerant crops should be selected.

The classification of ground water samples collected from monitoring wells for was carried out irrigation purpose and given below in **Table-6**.

It is clear from the **Table-6** that maximum number of samples (57%) falls under the category of high salinity water while nearly 43% of samples fall in very high salinity water category. This shows that the ground water in the pre-monsoon season from shallow aquifer in the district should be used for irrigation with proper soil and crop management practices..

Table-6: Classification of Ground Water for Irrigation based on EC.

Type	EC (µS/cm)	No. of Samples	% of Samples
Low Salinity Water	<250	Nil	Nil
Medium Salinity Water	250-750	3	43
High Salinity Water	750-2250	4	57
Very High Salinity Water	>2250	-	-
Total		**7**	**100.0**

4.6.2.2 Residual Sodium Carbonate (RSC)

Residual Sodium Carbonate (RSC) is considered to be superior to EC as a measure of sodicity particularly at low salinity levels. The classification of ground water samples based on RSC values for its suitability for irrigation purpose is shown below in **Table-7**.

Table-7: Classification of Ground Water for Irrigation based on RSC.

Type	RSC	No. of Samples	% of Samples
Good	<1.25	6	85
Doubtful	1.25-2.50	1	15
Unsuitable	>2.50	Nil	Nil
Total		**7**	**100**

The perusal of **Table-7** shows that the RSC values of ground water samples collected from the wells is less than 1.25 in about 85% of wells, which reflects that the overall quality of ground water in the monitoring wells is good for irrigation purpose. The high values of RSC (>2.50) was found in only 1 ground water samples collected from Pali village and is unsuitable for irrigation purpose.

4.7 Status of Ground Water Development

Ground water development depends on many factors viz., availability, crop water requirement, socio-economic fabric and on the yield of the aquifers existing in that area. Ground water in the area is being developed by three type of abstraction structures i.e., dugwells, borewells and tubewells. However dugwell is the main ground water abstraction structure in the district.

Ground water is predominantly used for irrigation, as it is the major ground water utilising sector. As per the 4th minor irrigation census data available for year 2006-07, area irrigated by ground water is 1463.24 sq. km., whereas the surface water accounts for about 82.43 sq.km. and the net irrigated area is about 1545.67 sq.km., thus ground water account for 94%, of net irrigated area. There are about 42151 irrigation dugwells in the district which, create an irrigation potential of 1350.56 sq.km., out of which 1287.99 sq.km., potential is utilised. In addition to this an irrigation potential of 175.25 sq.km. is utilised through 7476 borewells/tubewells.

State Government agencies have drilled number of borewells/tubewells fitted with hand pumps and electric motors for rural drinking water purposes in the district. In all till March 2012, GSDA, Government of Maharashtra is operating 8849 successful borewells/tubewells for rural water supply under various schemes in the district out of which 8472 have been fitted with hand pumps and 377 with power pumps.

4.8 Status of Water Conservation and Artificial Recharge measures

Beed is one of the chronic drought affected district of Marathwada. In most of talukas, villages are getting drinking water supply through tankers. In order to alleviate water problems different types of measures have been taken by various State Government departments. The activities taken under soil conservation in the district since 1992 are given in Table-7.

Table 7: Activities/Structures of Water Conservation.

S. No.	Water Conservation Structure	Unit
1.	C.C.T. (ha.)	15931
2.	Contour Bunding (ha.)	26548
3.	Loose Boulder Structure (No.)	70908
4.	Earthen Structure (No.)	29500
5.	Under Ground Bandhara (No.)	461
6.	Farm Pond (No.)	1202

7.	Nala Bandh (No.)	2260
8.	Cement Nala Bandh (No.)	1575
9.	Sunken Pond (No.)	172

Beside for creating awareness and inclusing peoples participation, programme like “Mahatma Jyotiba Phule Jal-Bhoomi Sandharan Abhiyan” has been implemented in the district from 2002 through district administration. The major works done under this programme during 2004-05 are given in Table-8.

Table 8: Major work done under “Mahatma Jyotiba Phule Jal-Bhoomi Sandharan Abhiyan” 2004-2005.

S. No.	Taluka	Vanrai Bandhara (No.)	Farm Pond (No.)	Well/Bore Recharging (No.)	Silt Excavation	
					No. of Water bodies	Silt Excavated (m^3)
A.	**Agriculture Department**					
1.	Beed	42	103	307	99	1,998
2.	Patoda	90	78	211	68	3,789
3.	Shirur	64	46	240	64	7,530
4.	Ashti	175	49	383	122	5,855
5.	Georai	30	41	650	98	9,642
6.	Majalgaon	38	73	400	72	4,250
7.	Ambajogai	40	251	243	75	33,400
8.	Parali (v)	60	230	379	126	29,600
9.	Kaij	39	255	399	106	4,420
10.	Dharur	15	37	194	32	1,857
11.	Wadwani	15	39	145	32	1,858
	Total (A)	**608**	**1,202**	**3,581**	**894**	**104,199**
B.	**Other Agencies**					
	Total (B)	**452**	**337**	**7,413**	**226**	**473,612**
C.	**Grand Total (A+B)**	**1,060**	**1,539**	**10,994**	**1,120**	**577,811**

Thus so far in the district, about 1060 Vanrai Bandharas, 1539 Farm Ponds, 11000 Well/Borewell Recharging and silt excavation in 1120 water bodies have been taken up.

5.0 Ground Water Management Strategy

Ground water has special significance for agricultural development in the district. The ground water development in some parts of the district has reached a critical stage resulting in decline of ground water levels over a period of time. Thus, there is a need to adopt an integrated approach of development of ground water resources dovetailed with ground water augmentation to provide sustainability to ground water development.

5.1 Ground Water Development

Major part of the district is underlain by Deccan Trap Basalt. The development potential of ground water in Deccan Trap Basalt is low to medium and ground water in the district can be developed through dugwells and dug-cum-bored wells (DCB) and borewells. However, the dugwells are the most feasible structures and borewells should normally be avoided as they generally tap deeper fractures, which may not be sustainable. Besides, the borewells

should only be used for drinking water supply and not for irrigation. The sites for borewells also need to be selected only after proper scientific investigation so as to minimise the rate of failure.

In the northern parts of the district along Godavari and Sindphana rivers, mainly occupied by Alluvium, the groundwater potential is medium to high and groundwater can developed through dugwells and shallow tubewells.

The overall stage of ground water development for the district is about 44% thus there is plenty of scope for further development of ground water resources. However, the ground water development needs to be carried out with proper care and planning, since in these areas falling water level trends are observed.

5.2 Water Conservation and Artificial Recharge

A number of water conservation structures in the form of check dams, percolation tanks, and KT weirs have already been constructed in the district. In Basaltic area, the artificial recharge structures feasible are check dams, gully plugs, percolation tanks, nalla bunds, etc. The structures like gully plugs, contour bunds are most favourable in the hilly areas, occurring in the central part of the district. Existing dugwells can also be used for artificial recharge, however, the source water should be properly filtered before being put in the wells. The artificial recharge structures suitable for alluvial areas are percolation tanks and recharge wells/shafts.

The farm ponds are also suitable water conservation cum artificial recharge structures feasible in the district. The farm pond is beneficial to the individual farmer as well as it helps in artificial recharge to ground water. Under special drive through district administration farm ponds were taken up on farmers field in the village Bramhanath Yelamb located in Shrirur taluka. In the village nine works of farm ponds were completed through Employment Guarantee Scheme (EGS). Due to this nine farm ponds, major part of the area in the filed was brought under irrigation and the intensity of drinking water problem was reduced to some extent in the village due to artificial recharge. This created good awareness in the farming community and they are taking active parts in implementing Govt. Scheme. Thus people need to be educated and made aware of the beneficial effects of the water conservation and artificial recharge structures and their participation needs to be involved in implementing Govt. schemes.

The sites for water conservation and artificial recharge need to be located where the hydrogeological conditions are favourable, i.e., where sufficient thickness of de-saturated/unsaturated aquifer exists and water levels are more than 5 m deep. Such areas are observed in southern parts of Beed, Kaij and Ambejogai talukas, western part of Georai, northern parts of Patoda and Beed talukas and major part of Majalgaon taluka of the district as seen from postmonsoon water level scenario.

6.0 Ground Water Related Issues and Problems

The drought area has been observed in entire district except the western part of the district around Ashti. Ground water quality is adversely affected by nitrate contamination in 50% of the samples. Continues intake of high nitrate concentration water causes infant methaemoglobinamea, popularly known as Blue Babies. Thus all the wells used for water supply should be first analysed for nitrate and also other constituents and if the contents are found beyond permissible limits then the ground water may be used for other than drinking purpose. Adequate sanitary protection to the wells may be provided to control the

nitrate contamination.

7.0 Areas Notified by CGWA/SGWA

As per ground water resource estimation all the talukas have been categorised as “Safe” and hence none of the taluka has been notified either by CGWA or SGWA.

8.0 Recommendations

1. Major part of the district is underlain by Deccan Trap Basalt, where only dugwells are the most feasible structures for ground water development.
2. The sites for borewells need to be selected only after proper scientific investigation. Borewells generally tap deeper fractures, which may not be sustainable. Besides, the borewells should only be used for drinking water supply and not for irrigation.
3. The overall stage of ground water development for the district is 50. 98%, thus there is a scope for further development of ground water resources particularly in all the talukas. However, the ground water development needs to be carried out with proper care and planning, since falling water level trend is observed.
4. The drought area has been observed in entire district except the western part of the district around Ashti.
5. The scope exists for construction of suitable artificial recharge structures in the district. The structures recommended for the hilly- Deccan Trap Basalt area in the central part are: contour bunds, gully plugs, nala bunds and check dams. For other basaltic areas, the nala bunds, check dams and KT weirs are suggested. The existing dugwells may also be used for artificial recharge of ground water provided source water is free of silt and dissolved impurities.
6. In Alluvial area of the district, percolation tanks and recharge wells/shafts are suggested.
7. The existing village ponds/tanks need to be rejuvenated to act both as water conservation and artificial recharge structures.
8. Ground water quality is adversely affected by nitrate contamination in 50% ground water samples collected in May 2011. Thus all the wells used for water supply should be first analysed for nitrate and if the content is found beyond permissible limits then the ground water may be used for other than drinking purpose. Adequate sanitary protection to the wells may be provided to control the nitrate contamination.